Regional Board staff responses to comments from the Yolo County Board of Supervisors' letter dated 19 April 2005

On 19 April 2005 Regional Board Chairman Schneider received a letter from the Yolo County Board of Supervisors, signed by Helen M. Thomson, Chairwoman. The letter contained several attachments that have been reviewed and addressed separately.

The following report contains staff responses to the comments provided in the letter. Note: Yolo County comments are in **bold** and staff responses are in plain text.

Recommendations

1. **The TMDL should focus on reducing mercury loads from abandoned mercury mines and geothermal sources in the upper watershed, not on regulating activities in the lower watershed that have little or no contribution to the problem. According to the RWQCB staff report, 15% of the ongoing mercury loading in Cache Creek can be directly attributed to the upstream mercury mines. 85% is attributed to unknown sources, although these sources are believed to be largely linked to historic mining activities in the upper watershed. There is little evidence of a significant contribution from current activities in the lower watershed.**

The goal of the TMDL is to reduce sources of total mercury and methylmercury into the watershed. A combination of source control in the upper watershed and prevention of the remobilization of contaminated materials in the lower watershed is needed to reduce loads. The TMDL does require load reductions from the inactive mercury mines and requires remediation of portions of the highly contaminated sediment immediately downstream of the mines. Since the mines may only constitute 15% of the ongoing pollution, the other 85% of the sources must be evaluated for potential remediation projects to make progress towards reducing fish tissue concentrations.

The Regional Board recognizes that loads from the mines need to be minimized prior to remediating creek beds down stream from the mines. The Regional Board will be implementing a cleanup program for the mine sites. The cleanup program will include a time schedule for completion of remedial activities. Cleanup of the mine sites not only includes the onsite waste piles but also some of the contaminated material directly downstream from the mines. Once mine sites are remediated, it is expected that there will be significant environmental improvements in the mine tributaries. However, cleanup of the mine sites alone is not sufficient to reduce sediment mercury concentrations in a reasonable amount of time in other parts of the watershed. The next steps will be to evaluate the feasibility of remediating more diffuse sources of mercury.

Other components of the mercury control program rely on not allowing any additional or new inputs of mercury or methylmercury to the system. The proposal does not require active removal of contaminated sediments in the lower watershed. Activities in the lower

watershed should not be allowed to increase mercury loads to downstream regions. The staff proposal requires stringent erosion prevention measures for all activities in the active stream channel (sections with elevated mercury concentrations) to preclude new mercury inputs. New sources of mercury or methylmercury will be precluded until Cache Creek has assimilative capacity for additional mercury.

2. **Monitoring and remediation activities should be paid for by federal and state funds (not local funds), as the presence of mercury in Cache Creek and other California waterways is the result of historic mining activities and natural erosion from a mercury-enriched watershed. In addition, all taxpayers gain from efforts to understand and remediate mercury transport and bioaccumulation because of the benefits to human health and wildlife.**

Monitoring and remediation, and the associated costs, of the inactive mines are the responsibility of the mine owners. Monitoring and remediation for projects conducted at the discretion of entities in the lower watershed should be the responsibility of those entities. Local projects are responsible for compliance with the TMDL. The Regional Board supports Yolo County efforts to secure federal and state funding for projects.

3. **The TMDL should not adopt a numeric objective for methylmercury in fish tissue that is substantially more stringent than the new National Criterion for the Protection of Human Health. As you know, Cache Creek is one of the most mercury-impaired waterways in the United States with abandoned mercury mines, massive residual bed loads of mercury, and a mercury enriched upper watershed. Under these circumstances, it may be unrealistic – for the purposes of regulatory actions – to require an endpoint that is more stringent than the National Criterion. (See Darell Slotton's analysis of TMDL mercury criterion calculations for Cache Creek fish and water for more information, enclosed).**

Staff provides alternatives from which the Regional Board will select water quality objectives for the Cache Creek watershed. Based on Dr. Slotton's suggestions, Staff expanded the number of alternatives. The USEPA strongly encourages use of local angling information in interpretation of their criterion[1]. Using information on popular fish species caught in Cache Creek, we included one of Dr. Slotton's suggestions (humans eating 50% trophic level three and 50% trophic level four fish from Cache Creek).

[1] "Several parameters in the Water Quality Criterion can be adjusted on a site-specific or regional basis to reflect regional or local conditions and/or specific populations of concern. These include the fish consumption rates and the relative source contribution estimate…EPA strongly encourages States and authorized Tribes to consider developing a criterion using local or regional data over the default values if they believe that they would be more appropriate for their target population". Source: USEPA, 2001. Water Quality Criterion for the Protection of Human Health, Methylmercury. EPA-823-R-01-001. January Chapter 7.2.

Water quality objectives for Cache Creek, however, must protect all beneficial uses, including consumption of local fish by wildlife species. Staff's recommended water quality objective, which is based on safe fish tissue levels for wildlife, did not change. Staff's recommended water quality objectives allow for slightly greater consumption rates by humans than the USEPA recommended criterion.

After Regional Board adoption, the USEPA and the US Fish and Wildlife Service (USFWS) will evaluate objectives with respect to whether they fully protect threatened and endangered species. In its evaluation of the USEPA's criterion, the USFWS stated that objectives greater than 0.3 mg/kg would not fully protect bald eagles[2]. In their evaluation of the draft Cache Creek TMDL, the USFWS recommended the approach that Regional Board staff used to calculate the fish tissue levels to protect bald eagles[3]. Please see Staff's response to Dr. Slotton's analysis for detailed comments.

In lower Cache Creek, current levels of mercury in fish are 2-3 times greater than the proposed objectives. It is expected that it will require an extensive amount of time to reduce fish tissue to the objectives. The proposed control program will be similar whether the objective is 0.2 or 0.3 or even 0.4 mg/kg- both load reductions in the upper watershed and load controls in the lower watershed are required to reduce sediment concentrations. The magnitude and extent of the control program may be modified as projects are completed and monitoring results document compliance toward meeting the objectives. The Regional Board will consider new information that suggests revisions to the numeric targets.

Comments

Monitoring and Remediation Requirements

1. **It is our understanding that the proposed TMDL requires a monitoring program and/or mitigation program for any project that may potentially discharge sediment to the creek or any of its tributaries if the finest grained portion of that sediment (which contains the greatest mercury concentrations) has an average mercury or methylmercury content greater than 0.2 mg/kg, 0.5 mg/kg maximum. It is further our understanding that this level, for this sediment fraction, likely applies to virtually all sediments in the watershed. The RWQCB should consider revising this requirement to ensure that discharges of sediment are lower in mercury concentration than the receiving sediments of the creek. In such cases, the sediment is actually diluting the mercury level in the creek.**

The implementation plan has been modified to clarify the areas where mercury monitoring or mitigation is required due to a project or activity that increases erosion. The proposed amendment requires remedial action if the sediment mercury concentration is greater than 0.4 mg/kg. In the lower watershed (below Rumsey), the requirement applies to the active stream channel, i.e., mercury contaminated areas within the mainstem Cache Creek stream channel, that are subject to erosion due to the 10-year flow

[2] USFWS, 2003. Report available at: http://sacramento.fws.gov/ec/bio-monitoring.htm
[3] See Appendix E of the Cache Creek TMDL report.

event. In the upper watershed, the requirement applies to the mainstem of Cache Creek and tributaries where staff have identified elevated concentration of mercury in sediment. Projects in the upper watershed would include changes in land management practices and anthropogenic activities that result in increased erosion (e.g., roads and grazing).

Naturally occurring erosion of cleaner sediment will in effect reduce the sediment mercury concentration although it may not necessarily reduce the mercury load.

Yolo County is suggesting that the Regional Board require (all?) discharges of sediment to have concentrations less than the receiving creeks. The 0.4 mg/kg concentration limit is expected to reduce overall sediment mercury concentrations. At this time, the Regional Board does not propose to lower the concentration limit to for the watershed to 0.2 mg/kg or less (Cache Creek sediment samples upstream of the confluence of Harley Gulch are generally less than 0.1 mg/kg).

2. **As stated in (1), it is our understanding is that any work, of any kind, that involves disrupting erodible soil or discharging water to the creek will trigger the monitoring and mitigation requirements in the proposed TMDL. The additional time and costs resulting from such requirements will dramatically delay or discourage wildlife habitat restoration, infrastructure maintenance, campground maintenance, bank stabilization, and other activities – for what appears to be very little benefit because of the relatively small contribution of such activities to the overall problem. Some of these activities may stop altogether because of the increased cost and workload. The RWQCB should clearly assess the benefits from regulating these activities before moving forward with the TMDL.**

The project areas that would require compliance with the TMDL include the active creek channel where sediment mercury concentrations are greater than 0.4 mg/kg and the project would result in net erosion or increased mercury or methylmercury loads. It is not unreasonable to require project proponents to conduct environmentally sound projects that control erosion and reduce mercury loading to the creek. The Clean Water Act essentially requires all projects, past and present, to minimize erosion and discharge into surface waters. The TMDL is not imposing additional requirements that are not already required through other storm water control programs (NPDES) for erosion control. Best management practices need to be incorporated into projects involving stream alterations and in channel work. The 401 water quality certifications and 404 permits discuss BMPs, monitoring, and mitigation for in-channel work. All of the activities mentioned in Comment 2 should already be incorporated BMPs for erosion control.

The Regional Board does not intend to limit restoration or improvement projects. The TMDL and proposed Basin Plan amendments are expected to improve water quality and protect humans and wildlife that consume fish from the Cache Creek watershed. Creek restoration projects share the same goals as the TMDL: protect and enhance water quality and wildlife habitat. Gravel mining has been moved off-channel due to the adverse

environmental impacts on instream mining. The TMDL is the next step in preventing erosion and reducing mercury loads.

3. **The TMDL is unclear as to whether the RWQCB plans to require ongoing mercury monitoring of the entire watershed. If so, the RWQCB needs to establish a coordinated, watershed approach to monitoring and should find federal and state funds to pay for it before requiring local entities to monitor for mercury. Towards that end, the RWQCB should also provide an estimate of the costs of a watershed-based approach to mercury monitoring. Our understanding is that samples for total mercury or methylmercury in water cost approximately $130/sample. Total mercury in sediment and fish samples cost $50/sample or more. Methylmercury in sediment and fish samples typically costs well over $100/sample. Such costs add up quickly, and these are only part of the costs of a monitoring program. The County, for example, spent over $100,000 for three years of mercury monitoring at the Cache Creek Nature Preserve and recently signed a contract for another $100,000 of monitoring. Such efforts cover only a very small area of the creek and more extensive monitoring could run into the millions of dollars.**

Staff is not proposing that the Regional Board require Yolo County or other entities to conduct mercury monitoring on an ongoing basis or to monitor the entire watershed. The peer review version of the Basin Plan Amendment staff report may have been unclear about monitoring. The most recent, public comment revision describes monitoring to be conducted by project proponents under the following situations: 1) monitoring for erosion that would be required for projects in the active channel with the potential to cause erosion, and 2) monitoring for methylmercury in water to ensure that new projects discharging water to the creek do not increase methylmercury concentrations. Monitoring of new water impoundments is highly recommended to evaluate design and maintenance methods to minimize methylmercury production.

The Regional Board will continue special studies in coordination with landowners and agencies to identify sources of mercury and methylmercury. We appreciate the research program funded by the County at the Cache Creek Nature Preserve (CCNP). Data from CCNP monitoring was reviewed for the TMDL. The County is to be commended for continuing this work to further our knowledge of the effects of wetlands restoration and management techniques.

4. **It is our understanding from reviewing the data in the staff reports that the RWQCB staff only took samples of sediment from the creek bed, not from the creek banks, drainages, and washes that discharge to the creek and its tributaries. Yet the RWQCB is assuming that mercury levels in the creek can be reduced if activities that involve the creek banks, drainages, and washes are regulated. The RWQCB should first collect information about the potential**

benefits of such regulations before requiring potentially costly monitoring and remediation activities.

Table 3.12 of the Cache Creek, Bear Creek, and Harley Gulch TMDL report shows data for the concentration of mercury in suspended sediment from 20 tributaries to North Fork Cache Creek, the Cache Creek Canyon, and Cache Creek below Rumsey. The sample size for most tributary measurements was small (N = 1-3). More recently, Regional Board staff has conducted two intensive surveys for sediment mercury concentration. The purpose of the sampling was to determine if there were tributary sources other than Harley Gulch contributing elevated levels of mercury. Data collection included major named tributaries into main stem Cache Creek and sediment from depositional areas within the high flow channel. Tributaries included Rocky Creek, Trout Creek, Cache Creek above confluence with North Fork, North Fork Cache Creek and its tributaries, Davis Creek, and Petrified Canyon. Creek bed and banks in the main stem between North Fork and Rumsey were also sampled. Depositional areas were selected from aerial photographs, topographic maps, and observations. Raw data from the first survey was provided in Appendix D of the staff report. Data from both surveys is currently being analyzed and a report is expected this summer. The data report will include maps indicating sample locations. Regional Board Staff is continuing its investigations in the watershed above Rumsey for sources of soils and sediment enriched in mercury. We are not focused on tributaries and drainages to Cache Creek below Rumsey, because there is no evidence that these are enriched areas (Table 3.12).

Our overall implementation goal of controlling erosion of soils/sediment enriched in mercury is based on the scientific understanding of methylmercury formation: the production of methylmercury in sediment is a function of total mercury concentration in the sediment (See Section 4.1.3 of the TMDL Report). By controlling sources highest in total mercury, we expect concentrations of mercury in the creek bed and subsequent methylmercury production will decline. A component of this is to reduce the introduction of total mercury into environments that readily methylate mercury. The Cache Creek watershed itself supports this expectation. In North Fork Cache Creek, concentrations of total mercury in sediment and water, methylmercury in water, and methylmercury in fish, are all much lower than in Cache Creek at Rumsey, which receives inputs from the inactive mines and other enriched areas.

5. **It is our understanding that short of reducing sulfur loading from geothermal sources (if feasible) and mercury loading from abandoned mercury mines, alternatives to stop the methylation of mercury in the creek would involve some sort of sterilization of the creek because mercury methylation is a natural byproduct of the functioning of a normal, healthy ecosystem. The RWQCB would have to remove sediment, organic matter, and biota to stop it, which would be very detrimental to the ecosystem. This is obviously an unrealistic approach. If the RWQCB's focus is only on preventing additional methylation in the creek by reducing additional loading of inorganic mercury, it should be clearly stated in the TMDL.**

The proposed Basin Plan Amendment describes reductions in methylmercury that are needed (See Tables IV-7 and IV-8 in Section 2 of the draft Staff Report), but the proposed implementation plan is not intended to "stop the methylation of mercury in the creek". Nor does Regional Board does not intend to remove all sediment, organic matter, and biota. The TMDL does discuss reducing sediment mercury concentrations as the method of reducing methylmercury production in sediment. This is accomplished by reducing mercury loads into the watershed. The amendment proposes to reduce methylmercury loading by prohibiting new discharges of methylmercury.

6. **The RWQCB states that the watershed above Rumsey is the major source of methylmercury and total mercury. The RWQCB should state clearly in the TMDL that it will focus its regulatory efforts on the watershed above Rumsey, not on the lower watershed. The TMDL currently mandates the same requirements for activities in the upper watershed and the lower watershed. As stated previously, the County believes that the RWQCB should focus its efforts on reducing mercury loadings from abandoned mercury mines and geothermal sources in the upper watershed.**

This point has been clarified in the public review draft report and in conversations between Regional Board and Yolo County staff. Investigations for "hot spots" of contaminated floodplain sediment and, if found, potential removal/remediation actions are only being considered for the watershed upstream of Rumsey. Likewise, identification of areas with mercury-enriched soil and requirements for erosion control on those lands will be occurring only in the upper watershed. For the watershed below Rumsey, Staff is proposing limited requirements over a relatively small area, which is the 10-year floodplain of Cache Creek. Sediment that deposits in the channel below Rumsey is enriched in mercury. The intent of the proposed requirements is to prevent erosion and mercury inputs caused by human activities from adding to mercury loads in the lower watershed, while reductions are occurring upstream. The proposed Basin Plan Amendment language describes that new projects or maintenance activities that will disturb sediment in the 10-year floodplain are required to implement erosion control practices and must mitigate if the project results in a net increase in erosion one year after the project. As described in the response to Comment 2, erosion control should already be performed when working under a stream bed alteration permit. Methylmercury minimization applies to the entire watershed.

7. **The TMDL currently seems to require local jurisdictions and individuals to control naturally occurring discharges of mercury to the creek. If this is not the case, the TMDL should clarify so as to avoid any interpretation to the contrary in the future.**

The proposed Basin Plan amendment requires control and management of anthropogenic sources of mercury. It does not require the control of sources of naturally occurring

mercury or geothermal sources. However, anthropogenic induced erosion in areas enriched in mercury must be controlled (e.g., erosion from grazing, road cuts, or timber harvest). The proposed Basin Plan amendment will reflect this.

Numeric Objectives

8. **The TMDL does not clearly show how sediment and water discharges into the creek will be connected to the numeric objectives of 0.12 mg/kg and 0.23 mg/kg for trophic level 3 and 4 fish, respectively. It is our understanding that science cannot yet accurately predict how discharges of mercury into the creek impact the methylmercury concentration in fish tissue. Sediment and water discharges to the creek should not be regulated if the RWQCB cannot demonstrably show that these discharges are a significant contributor to the problem of high levels of methylmercury in fish tissue.**

As noted in the response to Comment #4, the reduction of mercury concentrations in sediment is expected to result in the reduction of methylmercury produced in the sediment. The revised Linkage Analysis estimates that when the methylmercury aqueous concentration in Cache Creek is 0.14 ng/l the fish tissue target of 0.23 mg/kg will be attained. This linkage is based on existing information and will be re-evaluated if newer information becomes available (See revision to linkage analysis based on Dr. Slotton's suggestions, in Appendix H of the Peer Review version of the BPA Staff Report). Table 4.3 of the Cache Creek TMDL report provides a list of control measures performed at mercury sources and resulting declines in fish tissue concentrations of mercury. Although staff could not find reports of mine remediations in published literature, the results of control of other sources of mercury suggest that reducing discharges of total mercury in the Cache Creek watershed is expected to reduce fish tissue concentrations.

In the proposed Basin Plan Amendment, staff proposes that sediment and water inputs be regulated on a concentration basis. Erosion of sediments or soils with average concentration above 0.4 mg/kg caused by anthropogenic activity will be regulated. This includes erosion from the mine sites. It also includes erosion from human activity in tributary sub-watersheds with elevated levels of mercury and the active Cache Creek channel.

9. The proposed TMDL identifies representative fish species for each trophic level:

- **Trophic level 3: green sunfish, bluegill, and/or Sacramento sucker (rainbow trout also an option for North Fork Cache Creek); and**
- **Trophic level 4: Sacramento pikeminnow, largemouth bass, smallmouth bass and/or channel catfish (p. 15).**

Green sunfish do not belong in the same trophic category as fish like bluegill and Sacramento sucker. Green sunfish are not large but they are piscivores (fish eaters) that develop mercury levels more similar to bass, catfish, and crappie.

Their inclusion in the lower trophic level could lead to false apparent exceedences, relative to Trophic level 3.

We agree that green sunfish are likely more piscivorous than bluegills, rainbow trout, or Sacramento sucker. As described by Moyle (2002), "Green sunfish are opportunistic predators on invertebrates and small fish, feeding on a wider spectrum of prey than other sunfishes. Young-of-the-year feed on zooplankton and small benthic invertebrates. As they increase in size, they depend more on large aquatic insects, such as dragonfly larvae, terrestrial insects, crayfish, and fish". Cache Creek data suggest that green sunfish do not belong in the same category as the more piscivorous trophic level four fish. In Cache Creek between Rumsey and Yolo, concentrations in green sunfish (>100 mm) are 0.27 mg/kg. By comparison, concentrations in smallmouth bass and bluegill are 0.47 and 0.30 mg/kg, respectively.

10. The proposed TMDL states that the sample sets should include at least two species from each trophic level (i.e. bass and Sacramento pikeminnow, for Trophic level 4) collected at each compliance point or stream section (p. 15). Proposed requirements for extensive collections of two different species of Trophic level 4 fish and two types of Trophic level 3 fish at each monitoring site may be unrealistic. Intensive sampling efforts throughout the watershed during a UC Davis research project resulted in difficulty obtaining adequate samplings of just one representative of each trophic level and only rarely found two readily available Trophic level 4 species at any single location. This niche was typically occupied by one of the following species at each site: smallmouth bass, largemouth bass, or Sacramento pikeminnow.

The following has been added to the proposed Basin Plan Amendment language regarding number of species at each trophic level has been added:

> "If two species per trophic level are not available and are unlikely to be present, given historical sampling information, one species is acceptable".

11. The proposed TMDL also states that the samples should include a range of sizes of fish between 250 and 350 mm, total length (p. 15). The size requirements do not always make sense. In the case of the two sunfish species (green sunfish and bluegill), the 250-350 mm range is larger than typical fish in the population.

We agree. Maximum total lengths of green sunfish and bluegill sampled in Cache Creek are 160 and 250 mm, respectively. The proposed Basin Plan Amendment language will include, "Green sunfish and bluegill may not be available in this range. Those sampled should be greater than 125 mm total length."

12. The proposed TMDL states that the proposed concentrations in fish would protect the federally listed bald eagle (p. 24). It also appears that the 0.12 and

0.23 mg/kg target levels are based primarily on the bald eagle. It should be established what proportion of the year bald eagles fish in Cache Creek, in relation to nesting and raising of young. Mercury ingested from the watershed by adults could be a problem for young, even if they are raised at another location (through some egg transfer of mercury), but the criterion considerations are likely based on the assumption of local nesting and rearing of young eagles on a diet of Cache Creek fish. It seems that more research is needed to determine if eagles that winter seasonally in the Cache Creek canyon are impacted by mercury, especially since evidence suggests that the population is expanding.

The safe fish tissue levels for wildlife species are calculated assuming a consistent (as opposed to seasonal or episodic) intake of methylmercury. Bald eagles are in the Cache Creek watershed on a year-round basis; that is, both nesting and wintering (USBLM, 2002. Cache Creek Coordinated Resource Management Plan). Although the nesting population is small, it is possible that the individuals nesting remain through the winter. It is appropriate, therefore, to calculate safe levels for year-round intake of mercury from the Cache Creek watershed. We agree that more information on bald eagle feeding habits and effects of methylmercury exposure would be useful.

13. **According to the proposed TMDL, "The initial USEPA methylmercury criteria report did not describe how the criterion should be applied to fish species with different concentrations of methylmercury. The USEPA recommends, however, that the criterion be applied using information about local consumption. Most of the fish caught and kept from Cache or Bear Creeks are Trophic level 4 fish, such as catfish, bullhead, pikeminnow, and bass. Some trophic level 3 species, such as bluegill, may also be caught and kept for consumption (CDFG, 2004c; observations by Regional Water Board staff). Humans are unlikely to consume trophic level 2 fish from Cache or Bear Creeks. A logical way to interpret the USEPA criterion for Cache and Bear Creeks, then, is to assign the criterion of 0.3 mg/kg as the average concentration of methylmercury in locally caught trophic level 4 fish. This interpretation still assumes a consumption rate of 17.5 g/day, but accounts for the local situation that most fish consumed are trophic level 4 species." In the discussions of Alternative 3, the National Criterion of 0.30 mg/kg is presented in a substantially more restrictive interpretation than presented by the USEPA. The USEPA criterion assumes a mixture of species and trophic levels in the average fisherman's catch. The 0.30 mg/kg protective concentration level is clearly defined by the USEPA as being the average of mercury concentrations among all of the trophic levels contained in a typical mixed-bag catch. The modest level of consumption fishing along Cache Creek includes carp, sunfish, and small trophic level 4 fish, in addition to larger trophic level 4 fish. The fish tissue criteria calculations are discussed in much greater detail in the enclosed analysis entitled "Analysis of TMDL Mercury Criterion Calculations for Cache Creek Fish and Water."**

It is true that the USEPA criterion is based on a combination of trophic level 2, 3, and 4 fish consumed by adult humans. Consumption rates for these three trophic levels are summary data from a national diet survey. Consumption rates from an individual water body or watershed may not match the national summary data. As described in the response to Recommendation 1, the USEPA strongly encourages the use of local angling information. We have added a second alternative (Water quality objective alternative 4), which assumes a mixed-bag catch.

14. According to the proposed TMDL, "The goals of all of the proposed water quality objectives and the control program are to return mercury levels in fish tissue to levels that occurred in the premining period and to remediate mercury sources contributing to the mercury impairment. Regional Water Board staff considered providing the pre-mining condition as an alternative, but was unable to determine the pre-mining fish tissue concentrations of methylmercury. The proposed tissue and sediment concentrations are expected to result in fish tissue concentrations that would approach a natural background level." The TMDL does not appear to follow through with this reasoning. For this particular watershed, which is naturally highly enriched in mercury, including documented major mercury inputs from geothermal springs, the natural background level was likely never pristine and likely never will be. This should be taken into account in setting realistic goals and setting site-specific objectives.

It is true that the watershed has natural background sources of mercury (including mineralized zones and geothermal springs) that contribute to mercury in fish tissue. Due to the naturally occurring sources, it is expected that fish tissue will have residual levels of mercury once the anthropogenic sources of mercury are remediated. The proposed Basin Plan amendments focus on reducing mercury inputs from controllable sources and are expected to reduce fish tissue levels.

The water quality objectives and implementation plan recommended by Regional Board staff reflect our understanding that this is a region naturally elevated in mercury. The average mercury concentrations inTL4 fish from North Fork Cache Creek are currently below the recommended water quality objective, suggesting that the proposed objectives are not unattainable for Cache Creek. The analysis linking concentrations of methylmercury in fish and water was developed using site-specific (Dr. Slotton's) data. As shown in Figures 5.1 and 5.2 of the Staff Report, the recommended aqueous methylmercury goal for Cache Creek is at the lower end, but not below, existing conditions in the creek. The proposed erosion control requirements for mercury enriched soils and sediment (selected upper watershed soils and 10-year floodplains) also take into account the natural character of the watershed. Staff defined the background mercury concentration in soil of 0.2 mg/kg using watershed-specific data, instead of using a more general background concentration (average crustal abundance of mercury is 0.06-0.08 mg/kg). By proposing additional erosion control requirements on soils having double the local background, most of the Cache Creek watershed will not be affected by erosion control in the proposed Basin Plan Amendment

15. According to the proposed TMDL, "Wintering bald eagles feeding in Cache and Bear Creeks consume almost exclusively large, non-game fish species (USBLM, 2002; Slotton et al., 2004). Nesting by bald eagles in the Cache canyon has been observed since 2000 (USBLM, 2002)." An eagle-based criterion should be based on fish typically eaten by Cache canyon eagles, i.e. adult Sacramento suckers. The corresponding acceptable concentration in trophic level 4 fish (one of the primary targets for proposed monitoring and compliance) would be substantially greater than the acceptable concentration in the eagle diet.

Dr. Slotton has provided valuable information in his many observations of takings of Sacramento sucker by wintering bald eagles. This information is lacking, however, in terms of using it to determine fish tissue targets.

a. These observations have been made mainly, if not exclusively, on wintering bald eagles. We lack comparable observations of prey taking by nesting birds. As early developmental stages are particularly sensitive to adverse effects of mercury, observations during nesting and fledging are important.
b. Available observations of prey taking likely do not provide a complete picture of bald eagle diet. Cache Creek bald eagles may very well consume birds, even though taking of avian prey has not been recorded. To learn the complete diet, individual birds would have to be tracked at every meal. To learn the complete diet of nestlings, the nests would have to be carefully observed or prey remains counted (use of both methods preferred to remove any bias in prey identification from either method).

Regional Board staff used a bald eagle diet composition recommended by the USFWS. The USFWS has provided a detailed analysis for bald eagle feeding studies that include prey remains and/or nest observations (2003). The northern California study by Jackman and colleagues (J. Raptor Research, 1999, Vol. 33: p. 87-96), on which the diet composition is primarily based, covered river and reservoir habitats, but did not include Cache Creek. Jackman found fish comprised an average of 71% of bald eagle diet, with primary prey species being bullhead, Sacramento sucker, common carp and tui chub (the chub aren't present in the Cache Creek watershed, but are a TL3 species). These data suggest that bald eagles in the study could be representative of Cache Creek.

16. According to the proposed TMDL, "Although the Alternative 3 proposed fish tissue objectives are higher, the control program needed to achieve the objectives would be essentially the same for Alternatives 2 and 3. This is because the aqueous methylmercury concentrations that correspond to the fish tissue objectives are nearly identical: 0.06 ng/L methylmercury to achieve Alternative 2 in Cache and Bear Creeks and 0.07 ng/L to achieve Alternative 3." As above, this is based on a presentation of Alternative 3 that assumes people catch and consume entirely large, top predator fish of trophic level 4. It also interprets the UC Davis research on aqueous versus biotic mercury in a way that includes large levels of uncertainty. An alternative, direct approach based on the field research indicates protective water concentrations that are approximately 5

times higher than the criterion levels proposed as Alternative 3 (0.07 ng/liter) or Alternative 2 (0.06 ng/liter). This is discussed at length in the separate analysis document.

Please see our responses to Dr. Slotton's analysis. We have revised the linkage analysis based on his recommendations (aqueous goal corresponding to the recommended Cache Creek water quality objective is now 0.14 ng/L). We also added a water quality objective alternative assuming a 50/50 TL3 and TL4 mixed bag catch by humans.

17. **According to the proposed TMDL, "the recommended objectives protect a slightly higher proportion of the fish-consuming population than would be protected by Alternatives 3, which is based on USEPA's default consumption rate for the general population (p.36)." The recommended objective (Alternative 2) appears to be only slightly different than Alternative 3 because Alternative 3 assumes that all of the fish caught and consumed from Cache Creek are large individuals of top predator, trophic level 4 species. If Alternative 3 was in fact based on USEPA's default consumption rate for the general population, it would be substantially less restrictive than Alternative 3 as presented. As calculated in the companion analysis, Alternative 3, using the national default consumption rates, was found to result in Criterion-equivalent concentrations of 0.25 mg/kg for Trophic level 3 fish and 0.48 mg/kg for Trophic level 4 fish, as compared to 0.15 mg/kg and 0.30 mg/kg as presented, and as compared to the proposed (Alternative 2) levels of 0.12 and 0.23 mg/kg.**

Regional Board staff added a water quality objective alternative that assumes people eat a mixed bag (50% TL3, 50% TL4) of species from Cache Creek. Alternative 3 and the new Alternative 4 are indeed, based on USEPA's criterion. Yolo County is recommending that the Board adopt a water quality objective that assumes people eat TL2 fish or shellfish from the creek. This assumption is not supported by information provided by the State Fish and Game Warden, who has stated that Cache Creek anglers take primarily catfish and bass. Sucker and sunfish are taken occasionally.

18. **According to the proposed TMDL, "None of the proposed water quality objectives would restrict the development of housing in the Cache Creek watershed (p. 30)." As stated, all earth-moving operations anywhere in the valley or adjacent to the creek or a tributary would be subjected to the substantial additional costs of developing a mercury mitigation plan and conducting associated monitoring. It is our understanding that reference to the 100-year floodplain will be removed from the document. We suggest that the TMDL limit its scope to the immediately adjacent lands that may result in mercury discharges to the creek and that the focus should be on reducing mercury loadings from abandoned mercury mines and geothermal sources in the upper watershed.**

As noted before, the proposed Basin Plan amendment has been modified to address the control of mercury in sediment where mercury concentrations exceed 0.4 mg/kg. In the lower watershed elevated levels of mercury in sediment is generally limited to the active Cache Creek channel. In the upper watershed, more stringent erosion control measures are required in areas where elevated concentrations of mercury are present. Projects that have the potential to increase erosion should follow the conditions of water quality certifications and the requirements of the stormwater programs.

Beneficial Uses

19. The proposed TMDL adds commercial and sport fishing to the beneficial uses of Cache Creek (p. 6). The proposed TMDL also bases its criterion for methylmercury in fish tissue on assumptions about the number of fish that wildlife and humans eat from Cache Creek. The RWQCB staff stated at the March 18, 2005 meeting that there is not a commercial fishery on Cache Creek, but that there is a sport fishery. Additional information is needed before sports fishery is added as a beneficial use, and before assumptions are made about the number of fish that people and wildlife catch and eat from Cache Creek. Our understanding is that the actual amount of fishing, and in particular, consumption of fish caught in the Cache Creek watershed has never been studied and warrants additional investigation. The County is posting warning signs along Cache Creek to prevent consumption of contaminated fish, despite the lack of information about fishing.

Section 3.3 of the staff report describes the existing sport fishery in Cache Creek, North Fork Cache Creek, and Bear Creek. In summary, anglers have been observed in North Fork Cache Creek and Bear Creek in limited numbers. Cache Creek between the confluence with Bear Creek and the town of Capay is the most popular reach for angling. Regional Board staff has also observed people fishing in Cache Creek at the Road 102 crossing prior to the entrance of the Cache Creek Settling Basin. Fishing in Cache Creek occurs year round with peak fishing taking place in the spring and summer. As referenced in the report, anglers are keeping Bullhead, channel catfish, smallmouth and largemouth bass. We appreciate the County's initiative and expenditures in posting fish consumption warnings.

Addition of the sport fishing beneficial use to the Basin Plan listing clarifies Regional Board's record of the existing uses. No requirements or regulations are added by clarifying the Basin Plan use listing. Because sport fishing is known to be an existing use, water quality objectives would have to protect the use, whether or not the COMM use is added.

20. The existing and potential beneficial uses of Cache Creek and its tributaries are listed in Table 3.1 of the proposed TMDL. In addition, staff is proposing to add the COMM beneficial use to Cache Creek (including North Fork) and Bear Creek. Three existing beneficial uses, Municipal Supply, Recreation 1 and

Wildlife Habitat, are considered impaired due to mercury. The COMM beneficial category remains questionable and it is not clear how adding that category results in any further improvements. It is already stated that "Recreation 1" is impaired due to mercury. This is assumed to refer specifically to fishing benefits, as it would be incorrect to imply that other recreational benefits (e.g. swimming, rafting, etc.) are impacted due to mercury.

See response to Comment # 19 for the discussion of the existence of the sport fishing beneficial use. Yolo County is correct that the beneficial uses of swimming and rafting are not impacted by mercury. Adding the sport/commercial fishing beneficial use removes any confusion as to whether the Recreation 1 use applies to fish consumption or what part of Recreation 1 is impaired. Addition of the sport/commercial fishing use to the listing for Clear Lake was not controversial in adoption of the Clear Lake mercury TMDL.

Consistency with Other Regulations

21. As long as gravel companies conducting operations approved under Yolo County's off-channel mining plan are not discharging into the creek, the TMDL should specifically state that they are exempt from the TMDL requirements.

The proposed Basin Plan amendment applies to existing and future discharges of mercury and methylmercury to Cache Creek and it tributaries. If the gravel mining companies are not discharging or threatening to discharge mercury or methylmercury to the creek, then they are exempt from the specific requirements of the TMDL. However, the gravel mining companies must comply with all other applicable Basin Plan requirements, water quality objectives, and site-specific waste discharge requirements and permit or waiver conditions and limitations.

22. The RWQCB staff should make sure that the TMDL is consistent with other existing regulations, such as erosion control plans, stormwater regulations, and others. Our understanding is that other regulations are required to be consistent with the TMDL, once finalized, but there could be efficiency losses and unintended consequences if the TMDL is developed without regard to existing regulations.

The proposed amendment is consistent with existing Basin Plan water quality objectives for turbidity and with other regulatory programs such as the NPDES stormwater program.

23. The TMDL currently seems to consider irrigation drainage into the creek as a potential source of mercury subject to the requirements of the TMDL. The TMDL should specify how the mercury TMDL and the ongoing Ag Waiver Monitoring Program in Yolo County will be coordinated.

Irrigation drainage is a discharge. At this time staff does not know the relative contribution of mercury or methylmercury from agricultural drainage into Cache Creek. It is unknown if monitoring may be required in the future. If mercury monitoring were to be required, it would be coordinated and implemented through the regulatory program for agricultural discharges. The Ag Waiver program is still being developed.

Irrigated lands in the watershed below Rumsey are not in the area defined as having soil enriched in mercury. Activities on these lands would not incur any erosion control requirements because of the mercury TMDL.

24. According to the proposed TMDL on p. 32, "The federal antidegradation policy applies if a discharge or other activity, which began after 28 November 1975, will lower surface water quality." In relation to the proposed language regarding water and sediment discharges, this federal clause provides a precedent for not lowering surface water quality, as opposed to proposed language that implies a disallowance of flows that could be relative dilutions to existing water/sediment quality. Furthermore, the intent of the federal degradation policy is to protect existing high quality waters, so it is unclear how the RWQCB plans to apply the policy to Cache Creek.

The proposed Basin Plan amendment requires controls of sediment where mercury concentrations are greater than 0.4 mg/kg. The upper watershed, above Harley Gulch, has mercury concentrations in creek sediment that are below 0.2 mg/kg. By limiting the discharge of sediments containing mercury greater than 0.4 mg/kg, the average concentrations in the creek channels is expected to be reduced from existing levels in part from inputs from the upper watershed. Reduction of mercury sources is expected to result in decreased sediment concentrations and a reduction in methylmercury production.

Regional Board Staff response to the "Analysis of TMDL Mercury Criterion Calculations for Cache Creek Fish and Water".

The analysis of the criterion calculations was submitted as an attachment to a letter from the Yolo County Board of Supervisors to Robert Schneider, dated 19 April 2005. Please see Yolo County's letter for the full text of the analysis.

Regional Board Staff appreciates the effort taken to provide a thorough analysis of the proposed water quality objectives for methylmercury in Cache Creek. Staff carefully reviewed the differences between Dr. Slotton's reanalysis and the Staff's methods. Staff's changes to the Basin Plan staff report and, in some cases, justification for the original proposals are described below.

In an overall response, the reanalysis of proposed objectives appears propelled by Yolo County's understanding that "stringent" targets and aqueous methylmercury goals pushed Staff to recommend regulation of mercury and methylmercury inputs in the lower watershed, and that these regulations would be unnecessary if the targets were higher. The analysis recommends water quality objectives and aqueous methylmercury goals that are significantly greater than those proposed in the staff report. The staff recommended implementation actions would unlikely be different if the fish tissue objectives or aqueous goals were higher. Prohibitions on new, anthropogenic inputs of methylmercury or total mercury into the active channel of Cache Creek are intended to minimize additional loading while load reductions are implemented upstream. The proposed Basin Plan amendment does not propose to eliminate projects that will cause erosion of mercury –enriched material in the active channel or inputs of methylmercury, but is does require that projects monitor and mitigate to offset impacts.

Responses to section titled, "National Criterion calculations relating to Alternative 3 (Human Health)

Comments in this section are detailed and make frequent comparisons to the USEPA's methylmercury criterion for the protection of human health. The USEPA's calculations have been copied and appended to this response to assist Regional Board Members and other readers.

In the Summary, Dr. Slotton writes, "Review has concluded that the proposed fish criterion concentrations presented for the protection of human and wildlife health are substantially more restrictive that the intent of the EPA National Criterion for mercury". He supports this comment by using the USEPA's criterion to calculate criterion-equivalent concentrations for fish in trophic levels 2, 3, and 4. Staff responds with 2 points.

1. The USEPA methylmercury criterion was not developed to protect wildlife health. In a report on the protectiveness of the USEPA human health criterion for threatened and endangered wildlife in California, the US Fish and Wildlife Service determined that the

criterion would not protect bald eagles if the criterion was interpreted to allow the average methylmercury concentration in TL4 fish to be greater than 0.3 ppm (USFWS, 2003[1]). The fact that the USEPA criterion was not calculated to protect wildlife is an important factor behind Staff's selection of its recommended water quality objectives, which will protect humans and wildlife.

2. Dr. Slotton comments, "The National Criterion… should be an important benchmark option under consideration…". It is important to note that the USEPA criterion was not published with guidance on how to interpret or adapt the single criterion value to concentrations in multiple trophic levels. Any discussion of the USEPA's criterion should therefore distinguish the extent of the USEPA's criterion, and interpretations of it made by Dr. Slotton or Regional Board staff. The USEPA's criterion defines a methylmercury limit for the overall diet of 0.3 mg/kg in fish tissue, wet weight (USEPA, 2000). Although the approach followed by Regional Board Staff and Dr. Slotton of using translators (trophic level ratios and food chain multipliers) is a useful approach, it was not proposed by the USEPA to interpret the criterion. Regional Board Staff carefully considered possibilities for interpreting the criterion. All of the options shown in Table 1 of the comment letter and Alternatives 3 and 4 in the draft Basin Plan Amendment staff report are interpretations of the USEPA criterion. As described below and in the TMDL and proposed Basin Plan Amendment Staff reports, Regional Board staff chose to depend significantly on site-specific information for the trophic level translators and likely species of fish consumed.

Page 2, paragraph 2. Dr. Slotton questions whether carp should have been included as a trophic level 2 component of human consumption. Carp are omnivorous (Moyle, 2002). Regional Board staff classified carp as a TL3 species according to the definition provided in the Cache Creek TMDL report. Possibly carp in Cache Creek are closer to a TL2 classification. However, they are considered a potential component of human diet in the staff calculations. Mercury concentration data for carp (202-210 mm total length) were included in the calculation of average concentrations of large TL3 fish. Any additional information that Yolo County or Dr. Slotton could provide on angler fishing preferences would be considered in the analysis.

Page 3, bullet 2 and following, Use of National Criterion variables and assuming no commercial consumption. Dr. Slotton's analysis describes 0.4 ppm as "the equivalent Criterion safe average Hg concentration of angling catch, for people that obtain all of their methylmercury from locally caught fish". While this is indeed a calculation that can be made from variables used in the development of the USEPA's criterion, it is important to note that this is not part of the criterion. On page 4 and in Table 1, the commenter provided possible targets assuming people do not consume commercial fish. Given that the national diet survey showed that on average, people eat 12.5 g/day of commercial fish, Regional Board staff does not consider target alternatives that omit commercial consumption to be sufficiently protective of the general population. As seen in Table 2.6 of the TMDL report, Regional Board staff did consider non-consumption of commercial fish, in terms of providing safe consumption rates for various

[1] USFWS, 2003. Evaluation of the Clean Water Act Section 304(a) Human Health Criterion for Methylmercury: Protectiveness for Threatened and Endangered Wildlife in California. United States Fish and Wildlife Service, Environmental Contaminants Division, Sacramento Fish and Wildlife Office. October. Available at: http://sacramento.fws.gov/reports.htm

consumption patterns for a particular fish tissue mercury target. However, Regional Board staff did not create a target assuming people would not eat commercial fish. The highest possible targets shown in Dr. Slotton's Table 1 (TL4 fish concentration of 0.52 or 0.64 mg/kg) should be omitted from consideration.

Page 3, paragraph 3. The trophic level ratio between angling-sized fish in trophic levels 4 and 3 used by Regional Board staff is indeed 1.9. This value was based only on data from the Cache Creek watershed, not on fish from throughout the Delta, as commented. Lacking data for concentrations in large, TL2 fish, Regional Board staff agrees that as an estimation of the trophic level ratio between TL3 and TL2 fish, 1.9 can be used.

Page 5, calculation assuming 50% TL3 fish, 50% TL4 fish plus 12.5 g/day commercial fish: Regional Board staff evaluated this consumption pattern as a fourth Alternative for water quality objectives. The tissue concentrations based on 50% TL3, 50% TL4 consumption are 0.2 mg/kg in TL3 fish and 0.4 mg/kg in TL4 fish (values are rounded). Alternative 4 has been added to the staff report.

Responses to section titled," Wildlife Protective Calculations"

Dr. Slotton provides an alternative method for calculating safe fish tissue target values to protect the bald eagle, assuming the same diet composition that Staff used. In the Cache Creek TMDL report, Staff used the following equation for calculating the safe levels of mercury in various diet components:

$TDSL_{bald\ eagle} = (\%\ diet TL_3 * TL3_{conc}) + (\%\ diet TL_4 * TL4_{conc}) + (\%diet_{OB} * OB_{conc}) + (\%diet_{PB} * PB_{conc})$

Where: TDSL = safe concentration of methylmercury in total of bald eagle;
%diet TL3 = percent of biomass of TL3 fish in total eagle diet (and likewise for other diet components;
$TL3_{conc}$ = concentration of methylmercury in TL3 fish;
TL4 = trophic level 4 fish;
OB = omnivorous birds
PB = piscivorous birds

The TDSL is a known variable from previous calculations (see TMDL report for details), as are the percentages of each trophic level group in the diet. Including these variables, the equation becomes:

Equation 1

$0.195\ mg/kg = (0.58 * TL3_{conc}) + (0.13 * TL4_{conc}) + (0.13 * OB_{conc}) + (0.05 * PB_{conc})$

In order to solve the equation Staff put the four unknown variables in terms of the safe concentration of methylmercury in trophic level 2 aquatic biota (the least common denominator in the diet of large TL3 and TL4 fish, omnivorous birds, and piscivorous birds). There are no data for methylmercury concentrations in piscivorous or omnivorous birds in the Cache Creek

watershed. Therefore, staff used food chain multipliers (ratios between methylmercury in TL2 biota and the birds) developed from field data collected outside of the Cache Creek watershed. These multipliers were recommended by the USFWS. The USFWS provided a detailed literature review and explanation of the multipliers in its evaluation of the USEPA's methylmercury criterion (2003, pages 48-56). Although data for methylmercury concentrations in birds and their aquatic prey were not collected in the Cache Creek watershed, many of the birds examined, including grebes, herons, egrets, and other waterfowl, occur in the Cache Creek-Clear Lake area. The USEPA commissioned a review of the USFWS methodology by four independent, scientific peer reviewers. Overall, the reviewers agreed with the methodology used by the USFWS. They had no criticisms specific to the calculation of the food chain multipliers for omnivorous and piscivorous birds.

Dr. Slotton proposed an alternative method for solving Equation 1. His approach was to solve for the variable that is most represented in the diet, which is the concentration of methylmercury in TL3 fish (58% of diet). This approach is reasonable and may be preferable to the Regional Board/USFWS method, as bald eagles don't directly consume TL2 biota. The methylmercury concentrations in omnivorous birds, piscivorous birds, and TL4 fish are put in terms of the TL3 fish concentration. Again, because there is no tissue concentration data of omnivorous or piscivorous birds in Cache Creek, trophic level multipliers must be estimated.

Dr. Slotton proposes the following, found on Page 11 of his analysis:

> *Omnivorous bird concentration = TL3conc x **0.5***
> *Rationale: the diets of these birds, when they are present in the watershed, is estimated to be similar to that of the Sacramento suckers, which would lead to a multiplier of 1.0. Their typical short residence time in the Cache watershed is accounted for by reducing the multiplier by 1/2.*
>
> *Piscivorous bird concentration = TL3conc x **1.17***
> *Rationale: the diets of these birds, when they are present in the watershed, is estimated to be similar to the diets of TL4 fish, which would lead to a multiplier of 2.34. Their typical short residence time in the Cache watershed is accounted for by reducing the multiplier by 1/2.*

Staff has two responses to the omnivorous and piscivorous bird multipliers. First, taking of birds by eagles may not occur only in the winter. Grebes, herons and egrets nest in plentiful numbers in or around Clear Lake, within the foraging area of bald eagles nesting on Cache Creek. Thorough observations of the diet of nesting bald eagles in the Cache Creek watershed have not been made. Therefore, it should not be assumed that birds are not taken as prey. A study of 56 bald eagle nesting sites at Northern California rivers, lakes, and reservoirs (Jackman et al, 1999) showed birds consumed during the nesting period.

Second, Dr. Slotton assumes that the concentrations of methylmercury in large, TL3 fish and omnivorous birds will be the same because they feed on the same prey. Likewise, he assumes that large TL4 fish and piscivorous birds will have the same tissue methylmercury concentrations because they share the same prey. In order for Staff to apply these assumptions to calculating bald eagle fish tissue targets, field data or other supporting evidence are needed.

It is likely that fish and birds sharing the same prey types will not have the same tissue concentrations of methylmercury. For example, the average mercury concentration in muscle of Clear Lake grebes (piscivorous birds) was 2 mg/kg[2]. Average mercury level in large, piscivorous fish from Clear Lake in 1980-1984 was 0.5 mg/kg[3]. As another example, the food chain multiplier between great blue heron and double crested cormorant nestlings and their prey of Sacramento hitch at Clear Lake averaged 4.4 (range: 1.7-8.8, depending on bird species, year, and site)[4]. The food chain multiplier between largemouth bass and hitch in Clear Lake is 2.8 (Clear Lake TMDL Report).

Regional Board staff concluded that it could be possible to use Dr. Slotton's method for calculating safe methylmercury levels in bald eagle prey if sufficient data are provided to define and support trophic level ratios between omnivorous and piscivorous birds and large, TL3 and TL4 fish, respectively.

Page 7, paragraph 6 and page 8, last paragraph: Dr. Slotton refers to a bald eagle dietary study conducted in Northern California. This is the same study (Jackman and others, 1999) that was used by Regional Board staff as a reference for bald eagle dietary components. As Dr. Slotton used the dietary proportions proposed by Regional Board staff for his calculations on page 12, interpretation of this study is not an issue.

Responses to Section titled, "Aqueous Concentration Calculations"

Regional Board Staff revised the TMDL linkage analysis based on Dr. Slotton's recommendation to use a direct relationship between aqueous and large fish methylmercury concentrations. The revised linkage analysis is provided in Section 5.1 and Appendix H of the draft Basin Plan Amendment staff report.

[2] CDFG, 1984. Analysis of western grebe and coot samples received on 5 March 1984 for mercury. California Department of Fish and Game, Rancho Cordova.

[3] Fish data collected by CDFG. See Clear Lake TMDL report.

[4] Wolfe and Norman, 1998. J. Environmental Toxicol. Chemistry 17(2) 214-227

Water Quality Criterion for the Protection of Human Health: Methylmercury
Office of Science and Technology, Office of Water
U.S. Environmental Protection Agency Washington, DC 20460
EPA-823-R-01-001; January 3, 2001
Available at: http://www.epa.gov/ost/criteria/methylmercury/document.html

Section 7.0 Water Quality Criterion Calculation

7.1 Equation for Tissue Residue Concentration and Parameters Used

The equation for calculating the methylmercury fish tissue residue criterion is:

$$TRC = \frac{BW * (RfD - RSC)}{Fish\ Intake_{TL2 + TL3 + TL4}}$$

Where:
TRC = Fish tissue residue criterion (mg methylmercury/kg fish) for freshwater and estuarine fish
RfD = Reference dose (based on noncancer human health effects) of 0.0001 mg methylmercury/kg body weight-day
RCS = Relative source contribution (subtracted from RfD to account for marine fish consumption) estimated to be 2.7 x 10^{-5} mg methylmercury/kg body weight-day
BW = Human body weight default value of 70 kg (for adults)
Fish Intake = Fish Intake at trophic level (TL) 2, 3, and 4; total default intake is 0.0175 kg fish/day for general adult population. Trophic level breakouts for the general population are: TL2 = 0.0038 kg fish/day; TL3 = 0.0080 kg fish/day; and TL4 = 0.0057 kg/fish/day.

This yields a methylmercury TRC value of 0.3 mg methylmercury/kg fish (rounded to one significant digit from 0.288 mg methylmercury/kg fish).

This equation is essentially the same equation used in the 2000 Human Health Methodology to calculate a water quality criterion, but is rearranged to solve for a protective concentration in fish tissue rather than in water. Thus, it does not include a BAF or drinking water intake value (as discussed above, exposure from drinking water is negligible). The TRC of 0.3 mg methylmercury/kg fish is the concentration in fish tissue that should not be exceeded based on a total consumption of 0.0175 kg fish/day.

7.2. Site-Specific or Regional Adjustments to Criteria

Several parameters in the Water Quality Criterion equation can be adjusted on a site-specific or regional basis to reflect region or local conditions and/or specific populations of concern. These include the fish consumption rates and the RSC estimate. States and authorized Tribes can also choose to apportion an intake rate to the highest trophic level consumed for their population or modify EPA's default intake rate based on local or regional consumption patterns. EPA strongly encourages States and authorized Tribes to consider developing a criterion using local or regional data over the default values if they believe that they would be more appropriate for their target population. States and authorized Tribes are encouraged to make such adjustments using the guidance provided in the 2000 Human Health Methodology (USEPA, 2000).